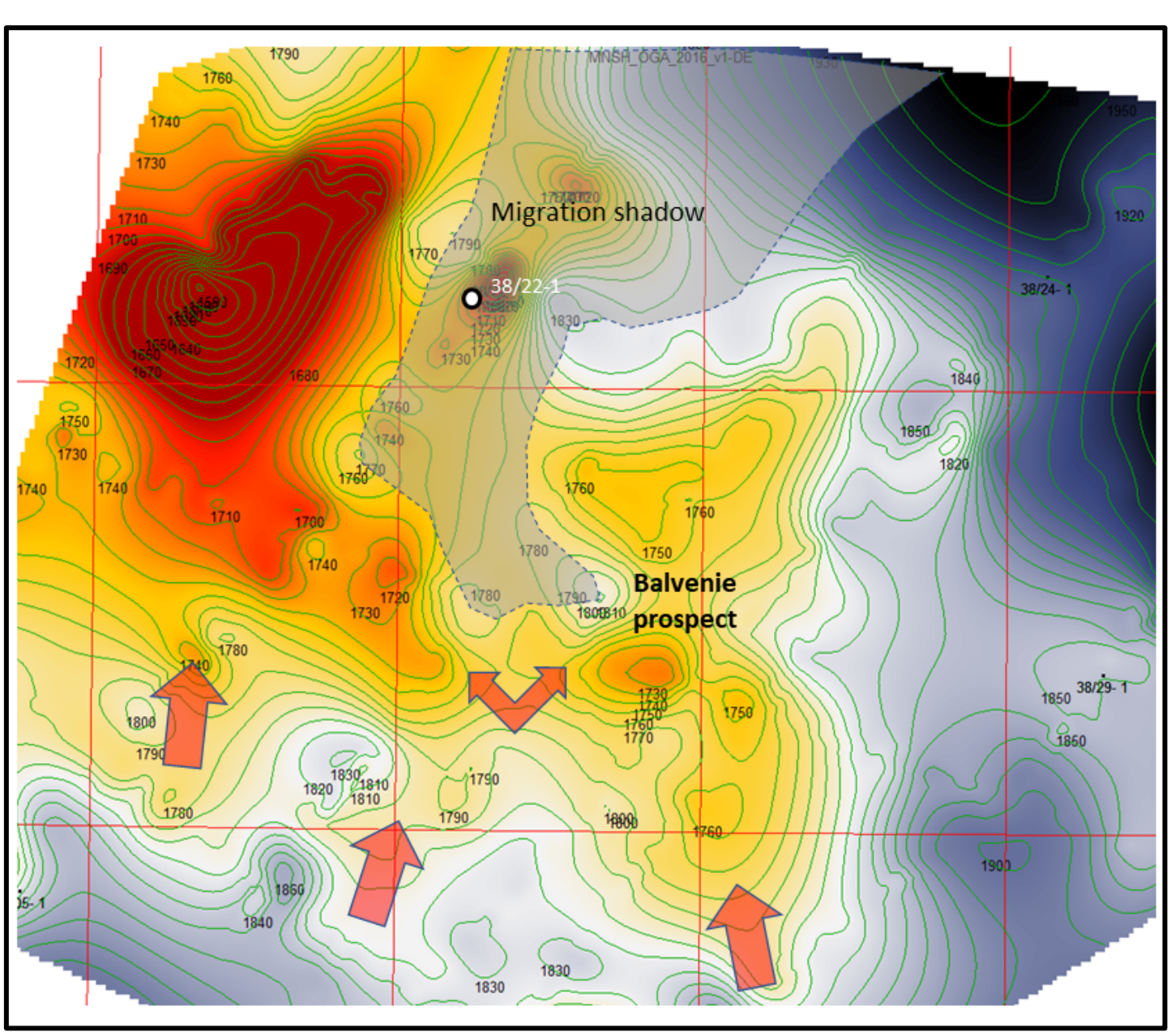
THE BALVENIE AND DURHAM PROSPECTS
UKCS OFFSHORE PRODUCTION LICENCES P2331&P2487



FARM-IN OPPORTUNITY
DECEMBER 2019

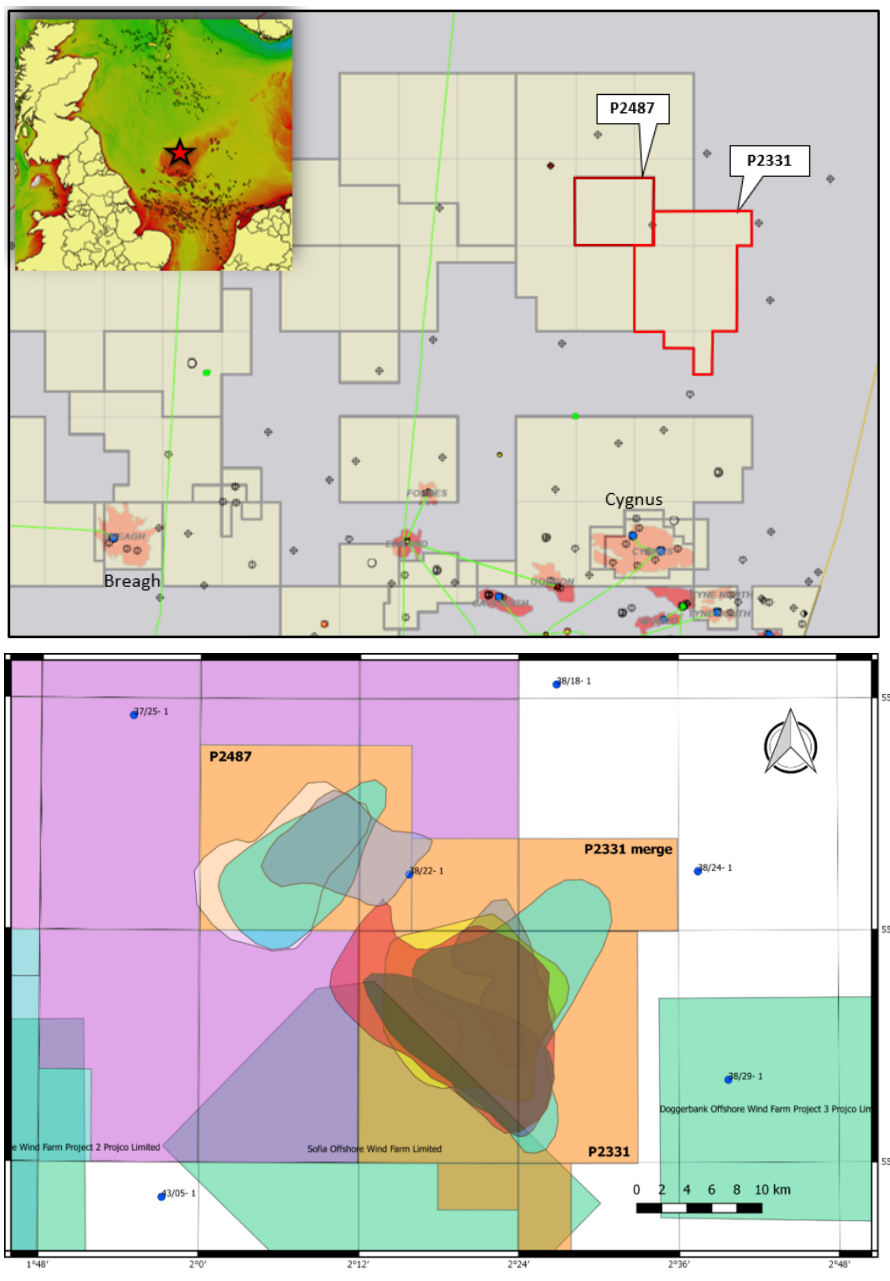
OFFSHORE UKCS P2331&P2487 – BALVENIE AND DURHAM PROSPECTS
HIGH IMPACT OPPORTUNITY

Draupner Energy is pleased to offer a participating or operating interest in licences P2331 and P2487 in the UK sector of the Southern North Sea. The main potential – ca. 350 mmboe of gas with an oil leg upside - has been identified in very large Zechstein Hauptdolomit 4-way dip closures. Additional potential of the same order of magnitude but with higher geological risk is present in the underlying Devonian and fractured Basement 4-way dip closures. Draupner Energy is now planning to participate in a multi-client 3D seismic survey covering both licences (ca. 1,000 km^2), alternatively conducting a smaller proprietary 3D seismic survey. The preferred timing of seismic acquisition is during 2020-2021.

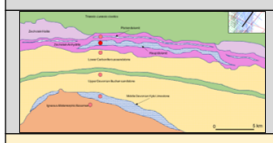
1. Introduction

Production licence P2331 was awarded on 15 May 2017 to Draupner Energy Limited (Draupner Energy) in the 29th Seaward Licensing Round. In July 2019 Draupner Energy was awarded a northerly extension to P2331 and adjacent licence P2487 in the 31st Licensing Round, with the two licences covering in total 888 km^2. The licensed acreage is located on the south-eastern part of the Mid North Sea High ca. 40 km north of the Cygnus field, one of the largest gas fields on the UKCS. Draupner Energy is seeking one or two additional companies to join the licence groups before embarking on the next exploration phase entailing 3D seismic acquisition.

The initial term for P2331 is 9 years (3+3+3 years for phases A, B and C) whereas P2487 has a 7 years initial term (3+2+2 years for phases A, B and C). Draupner Energy has fulfilled phase A work commitment for P2331 and aims to move into phase B on 15 May 2020 which entails acquisition, processing and interpretation of 3D seismic. The G&G work during Phase A work has revealed a very large remaining hydrocarbon potential in multi-target 4-way dip closures; Balvenie in P2331 and Durham in P2487 with the Zechstein Hauptdolomit as the primary objective at ca. 2000 m depth. In a pure gas case, the combined Balvenie and Durham Hauptdolomit has a **mean gas-in-place potential of 2.7 TCF gas (up to 1.9 TCF recoverable)**, however recent oil discoveries in West Newton and Ossian-Darach have increased the likelihood for finding oil. A Balvenie combined oil and gas case with a 35 m oil column results in a mean recoverable oil potential of **385 mmbbls**, however volumetric constraints from Carboniferous and Permian oil source rocks makes a **100-200 mmbbls** potential a more likely scenario. Additional potential of the same order of magnitude is present in the



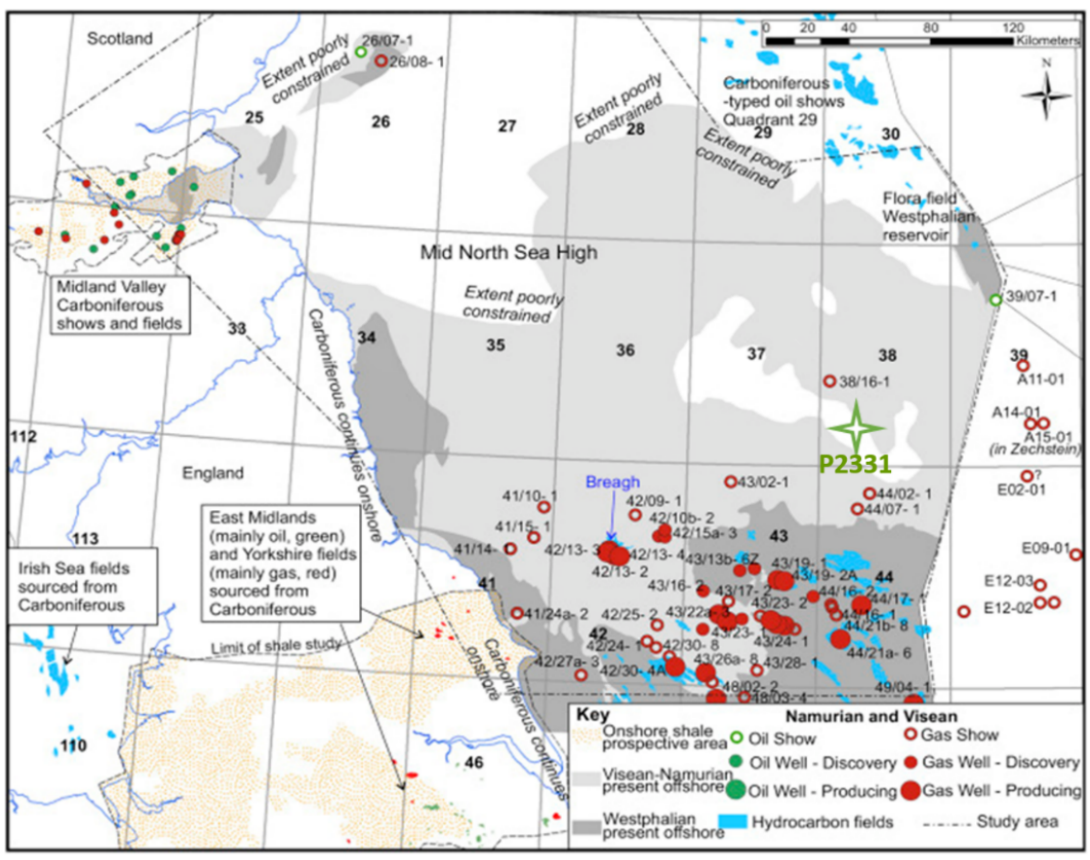
underlying Upper Devonian Buchan sandstones, Middle Devonian Kyle carbonates and fractured Basement at ca. 2400-2700 m depth directly underlying the Hauptdolomit main target.

Target	Lithology	Mean Recoverable Gas Volume (BCF)	
		P2331 Balvenie Prospect	P2487 Durham Prospect
Upper Zechstein Plattendolomit	Dolomite	398	265
Middle Zechstein Hauptdolomit	**Dolomite**	**1160**	**723**
Lower Carboniferous Scremerston	Sandstone	42	107
Upper Devonian Buchan	Sandstone	870	-
Middle Devonian Kyle	Limestone	312	-
Fractured Basement	Granitic	1271	-

Licences P2331 and P2487 are located in shallow water (ca. 25-35 m), near gas production and export infrastructure (Cygnus, Esmond, SEAL pipeline, WTG in the Netherlands). There are several wind farm developments planned in the area, however P2487 (with the Durham prospect) is located outside of these wind farm projects whereas more than 95% of the Balvenie prospect is located outside (north of) the Sofia wind farm project (Sofia). The wind farm activity should hence be of no hindrance to exploitation of the hydrocarbon potential in P2331 and P2487. Draupner Energy is in a regular dialogue with the Sofia Operator *Innogy Renewables UK Limited* (Innogy) to ensure there is mutual exchange of information with the aim to coordinate exploration and wind farm operations. Offshore wind farm surveys are currently planned for 2020, with offshore construction to commence in 2022, meaning 3D seismic should be acquired either during the 2020 or 2021 season.

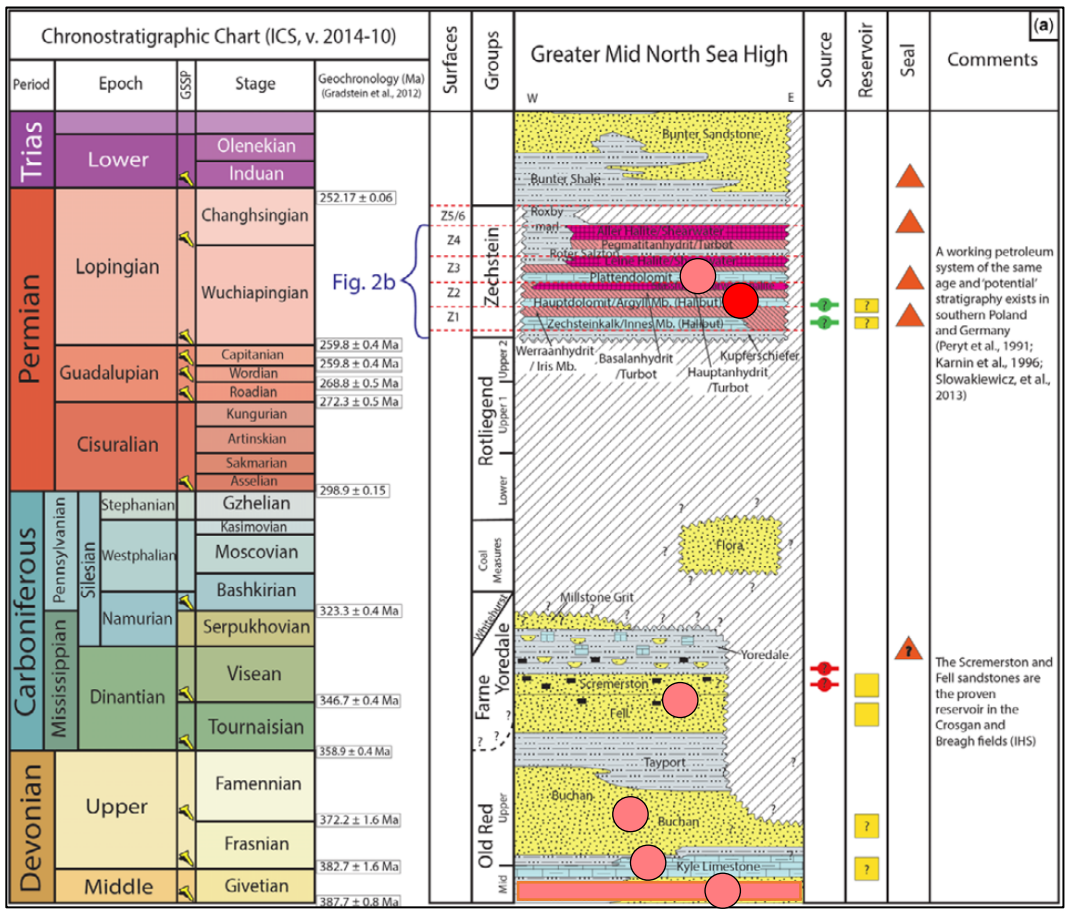
2. Regional geology and main petroleum plays

The area covered by P2331and P2487 is located in the Southern North Sea (SNS) and geologically part of the large positive structure called the Mid North Sea High. The proven petroleum systems are located within the Upper Paleozoic and lowermost Mesozoic and the petroleum activity in the area is dominated by gas production from Upper Paleozoic and Triassic plays. The primary reservoirs are the Lower Permian Leman and Rotliegendes sandstones (Leman), the Lower Triassic Bunter sandstone reservoirs (Gordon), and Upper Carboniferous sandstones (Cygnus), with minor production from Lower Carboniferous sandstones (Breagh) and Upper Permian Zechstein dolomites (Hewett).



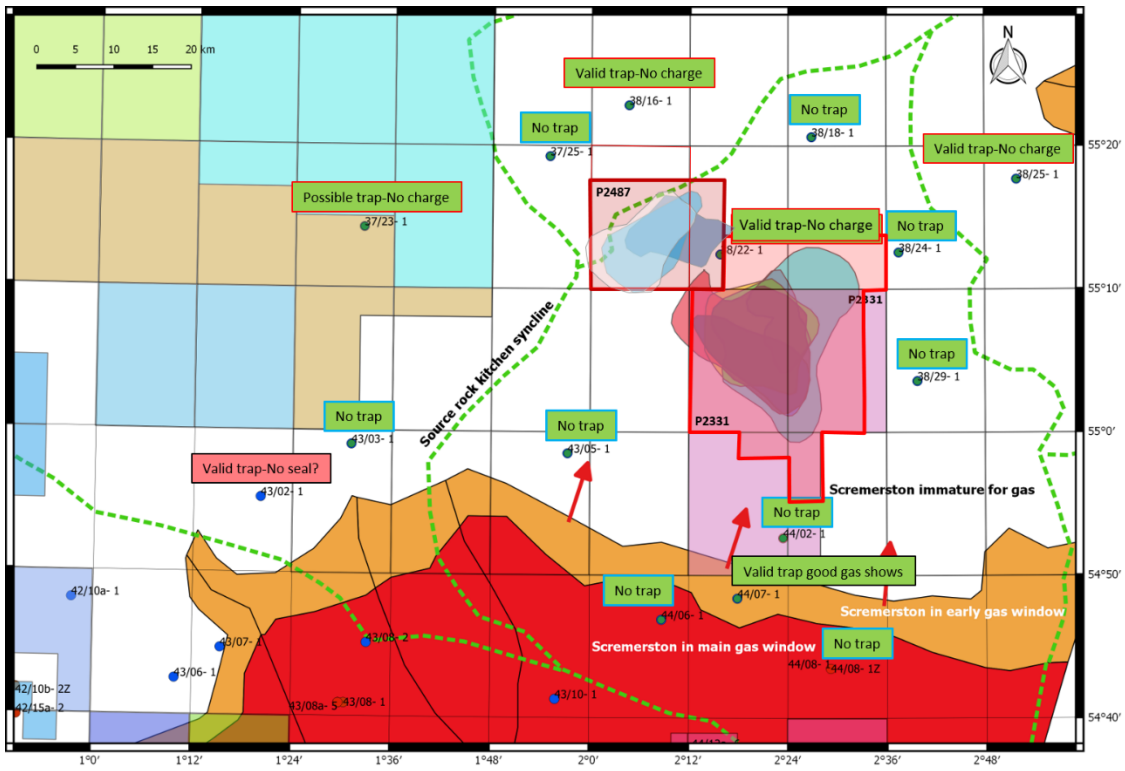
The area is primarily dominated by good quality, relatively dry gas with minor amounts of inert gases and a low content of hydrogen sulphide, however thin oil zones and oil shows have been encountered in several wells nearby P2331 and P2487 and the area's oil potential has recently been reinforced by the oil discoveries in West Newton and Ossian-Darach. Gas and minor condensate is mainly sourced from the

Upper Carboniferous coals and organic rich shales of the Westphalian coal seams, however the Lower Carboniferous Scremerston Formation is also a very good source rock which is more deeply buried than the Westphalian and is considered the main source rock for the Breagh Field and Crosgan discovery. Organic rich shales in the Scremerston also have considerable oil potential, complemented by the Upper Permian Marl Slate (Kupferschiefer) which has excellent oil potential and is mature for oil generation in large parts of the area. The Marl Slate is normally thin in well penetrations but may thicken in basinal parts and represent an additional source for oil generation. Intra-Zechstein high-organic facies (Stinkkalk) represent additional oil potential.



Most of the hydrocarbon traps are structural in nature, *i.e.* they have a 4-way dip closure at top reservoir. A stratigraphic trap component has been reported for some fields, with the coals and shales of the Carboniferous creating base seals in truncation traps. Accumulations in the Zechstein Hauptdolomit and Plattendolomit rely on anhydrite or halite top seals. The Upper Permian Zechstein evaporites also provide the main top seal for the Lower Permian and Carboniferous reservoirs with Carboniferous intraformational seals creating stacked pay zones in fields like Cygnus. The Zechstein Hauptdolomit play has recently seen a revival with Shell farming into Cluff Natural Resources' Pensacola prospect, ONE-Dyas's Ossian-Darach discovery and the very promising West Newton discovery onshore near Hull.

3. Exploration history and dry wells review



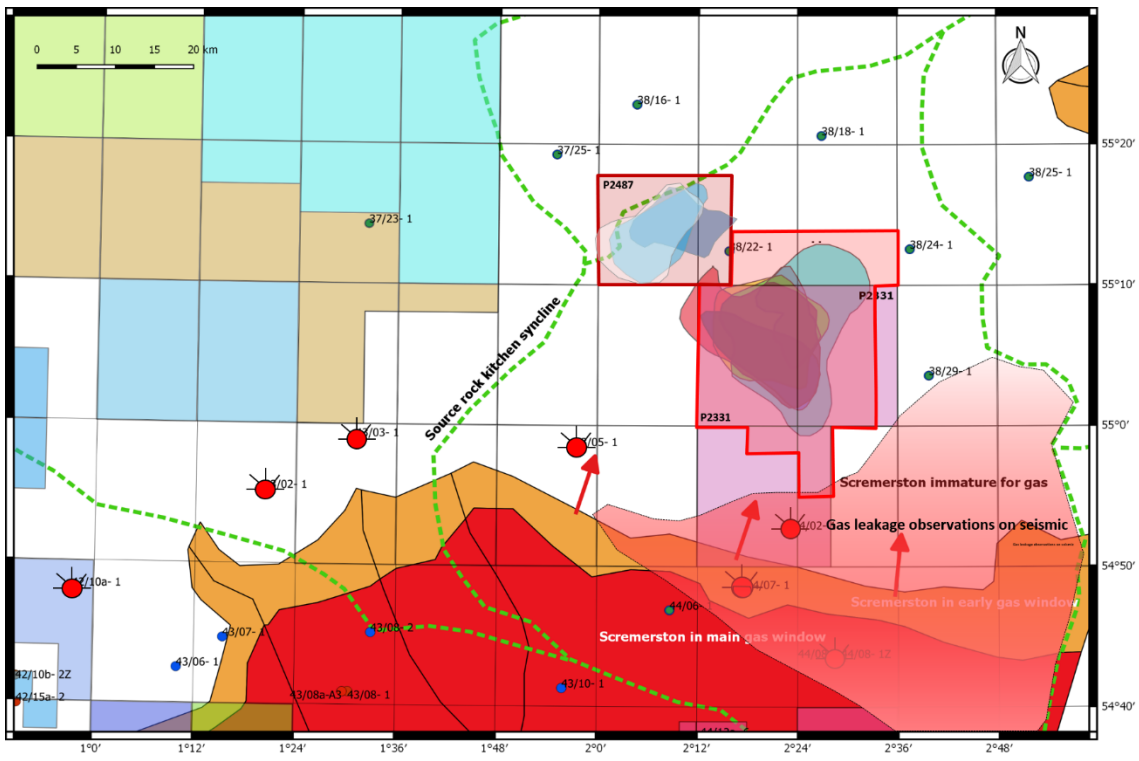
The Mid North Sea High was the scene for some of the earliest offshore hydrocarbon exploration starting in 1964 (well 38/29-1) and the drilling of 13 exploration wells before 1970. At this time the seismic data was widely spaced and of poor quality with no reliable image below top Zechstein. None of these wells were successful although shows of gas and oil were encountered in some of the wells. In hindsight many of the operators concluded that they had drilled outside structural closure (*e.g.* well 38/29-1) and hence had not performed a valid test of the petroleum potential. With the advent of better-quality seismic data and the discovery of large gas fields on the UKCS farther to the south (*e.g.* Gordon, Cygnus) five more exploration wells were drilled between 1983 and 1994, but still with limited technical success and no commercial success. Draupner Energy has performed a rigorous dry hole analysis and concluded that none of the wells located south of P2331 and P2487 drilled structural 4-way dip closures except for discovery well 44/7-1 proving the Gressingham discovery with ca. 34 BCF of gas in the Carboniferous/Permian and a meter of oil in the overlying Zechstein dolomites which also exhibit excellent gas shows. Failure in wells drilled to the south of P2331 is hence likely to be due to the lack of valid traps.

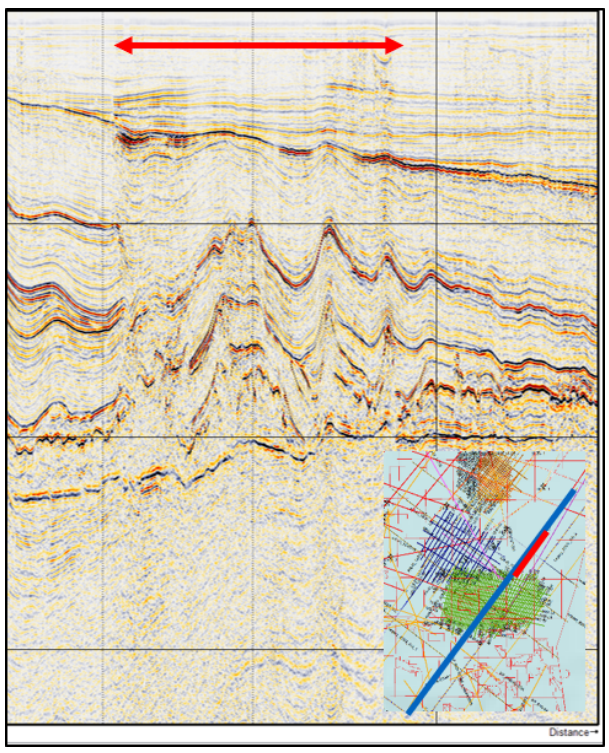
To the north of P2331 and P2487 some exploration wells were also drilled on targets without valid closures, however at least three of the wells drilled valid 4-way dip closures and had adequate reservoir properties but still failed to prove significant hydrocarbon occurrences, which must be attributed to either seal failure or lack of hydrocarbon charge, the latter being more likely.

4. Plays and prospectivity

4.1 Source and charge

A very large hydrocarbon generating kitchen area is located ca. 25 km south of the Balvenie and Durham prospects. The primary source rock is the Lower Carboniferous Scremerston Formation which contains coals and organic rich shales with TOC of up to 40% and HI of typically 250. The median total amount of generated gas in the drainage area for the Balvenie prospect has been calculated to ca. 135 TCF, providing a very large gas charge supply to Balvenie which has a most likely gas-in-place volume of about 1.5 TCF and maximum 7 TCF, hence an oversupply of 20-90 times the prospect volumes. The Scremerston and Marl Slate and potentially the Zechstein Stinkkalk also have oil potential and ca. 2 and 5 billion bbls of oil is estimated to have been generated within the kitchen area. The likelihood for oil in Balvenie and Durham has increased following the 2019 onshore West Newton discovery followed by the very encouraging Zechstein oil discovery in ONE-Dyas's Ossian-Darach well.

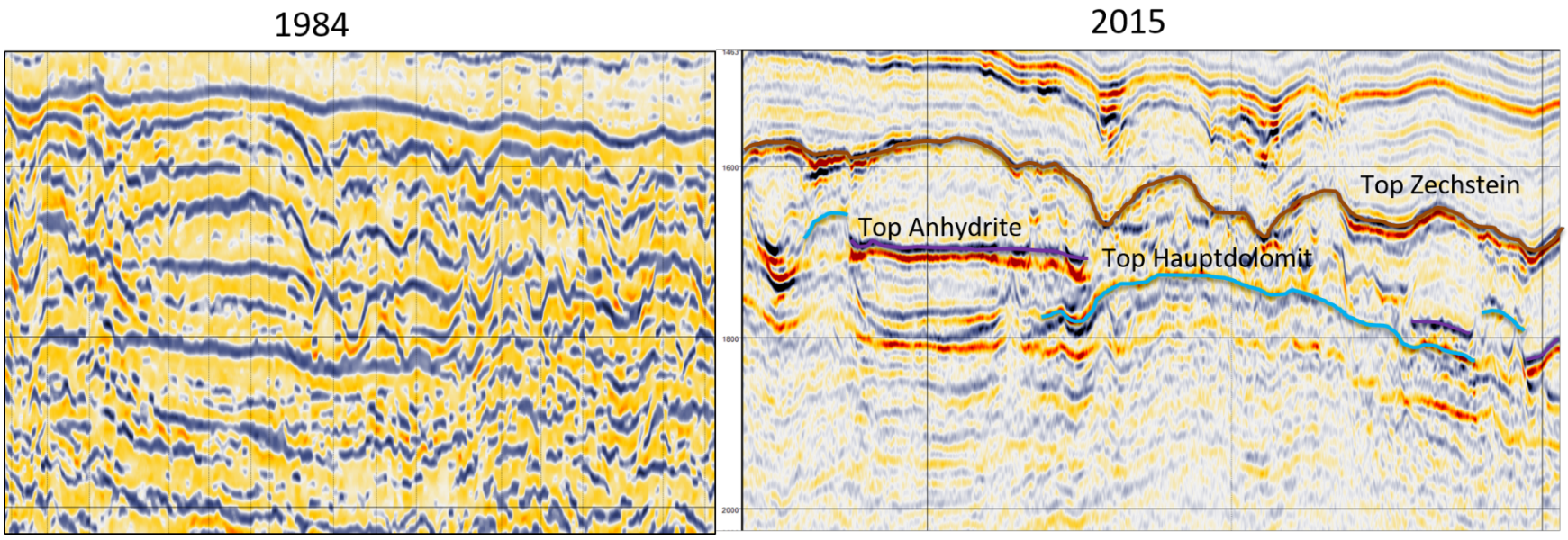




Active hydrocarbon migration is supported by the occurrence of gas and oil shows in all wells south of P2331. Seismic amplitude bright spots indicative of gas occurrence and leakage within the Dogger Fault Zone have been observed in an area stretching from well 43/5-1 in the west to 38/29-1 to the east and into the Dutch sector, further supporting active gas generation and migration. Hydrocarbon charge into the Hauptdolomit is likely to occur where it is located close to the base of the Zechstein Group as seen in *e.g.* wells 44/7-1 and 44/2-1, alternatively farther north through a network of faults and fracture systems associated with the Dogger Fault Zone. Onshore outcrops of the Hauptdolomit equivalent show spectacular collapse breccias, and these breccias have also been seen in core specimens from *e.g.* well 38/24-1. These features may well have acted as hydrocarbon migration conduits from the base Zechstein into the Hauptdolomit.

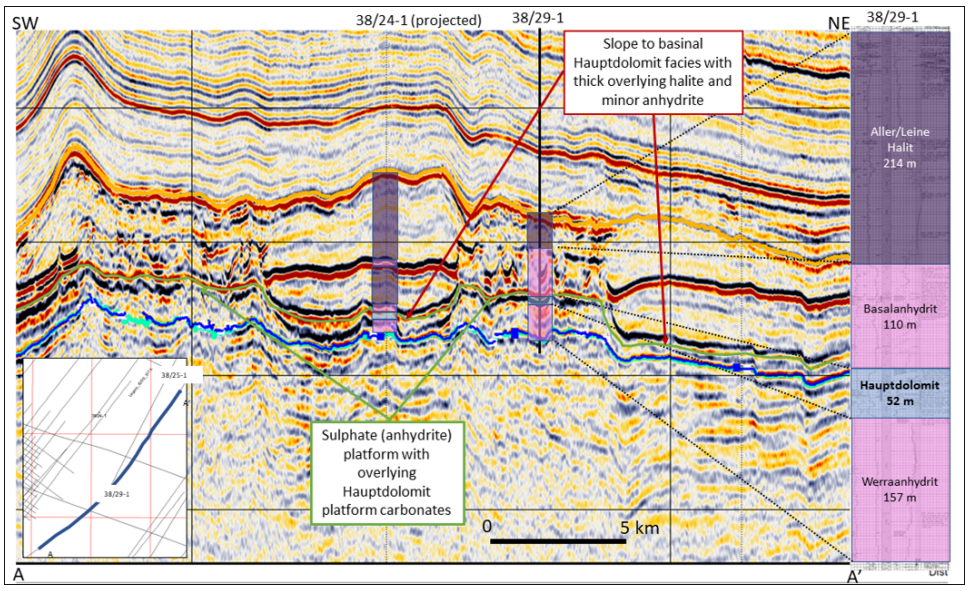
4.2 Seismic data quality, seismic stratigraphy and reservoir mapping

From the advent of exploration drilling in the early 1960's until the mid-1980's the seismic data quality in the area was generally poor, and only allowed adequate mapping of the top Zechstein and shallower horizons with confidence, and the targeted intra-Zechstein and sub-Zechstein targets were mainly based on expected conformity with the top Zechstein.



As mentioned earlier, this approach failed. The reason for this is three-fold:

1. Firstly, Hauptdolomit reservoir thickness and quality is best developed on paleo sulphate platforms with thin or no halite overburden, flanked by basinal areas with thick halite. Subsequent compressional structuration and halokinesis created structural closures at top Zechstein level preferably where there is thick halite, i.e. in basinal areas. Hence many wells targeting top Zechstein closures drilled through paleogeographic lows with thin and poorly developed Hauptdolomit facies.
2. Secondly, the compressional structuration process created several top Zechstein closures that are not underlain by Hauptdolomit closures and vice versa, i.e. structural lows at top Zechstein level are often underlain by structural highs at top Hauptdolomit level, hence several Hauptdolomit closures remain undrilled (*e.g.* Balvenie and Durham).
3. Thirdly, the large lateral seismic velocity variations within the Zechstein evaporite sequence often leads to incorrect identification of sub-Zechstein closures on seismic time maps.

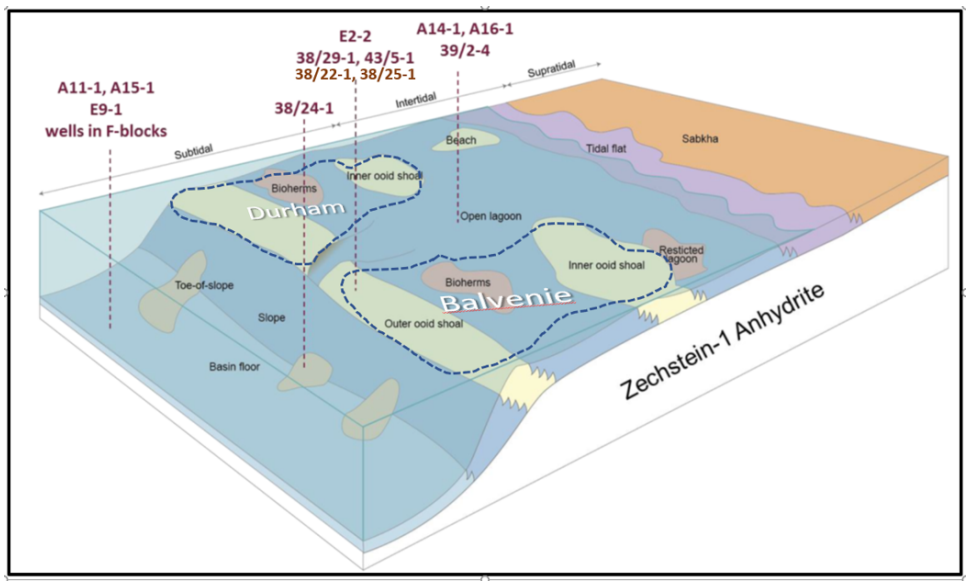


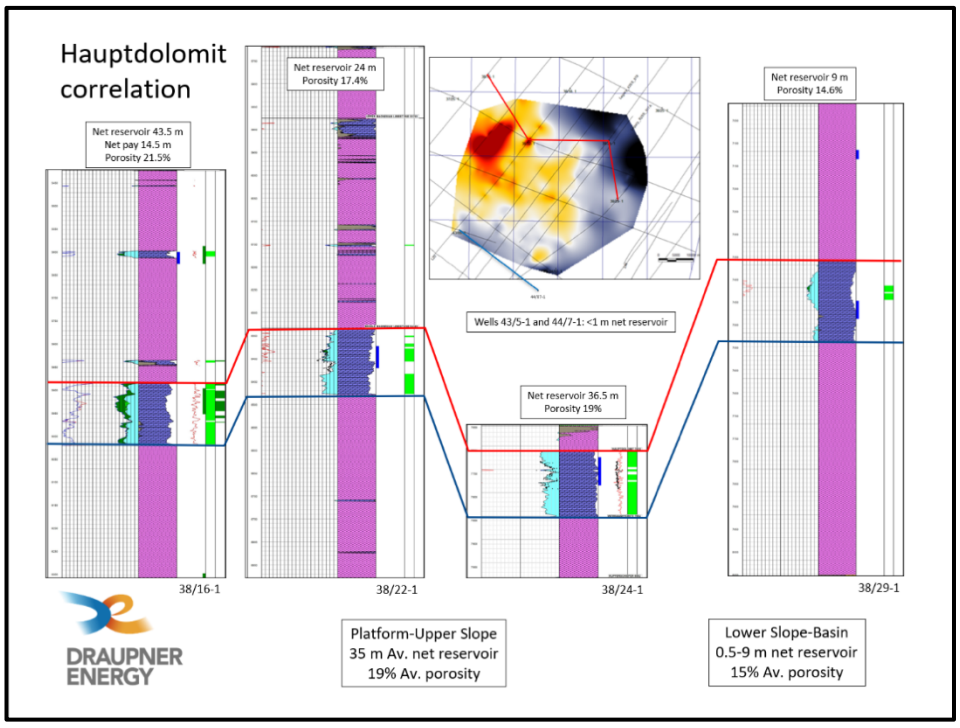
With the help of the 2015 broadband seismic data provided by the OGA in 2016 a clear Zechstein picture emerged allowing the identification of the main units and establishment of a seismic stratigraphic and geological framework. Sulphate platforms with well-developed Hauptdolomit platform dolomite facies could now easily be identified and mapped with confidence, also using vintage data calibrated with the high quality OGA data. The OGA data also made mapping of top basement and the identification of Mid-Devonian Kyle carbonates an easier task. The top of the Upper Devonian Buchan Formation cannot be mapped directly due to the lack of good reflectors and poor seismic quality at this level but has been inferred from geometric interpolation between the Base Zechstein and top Basement which both were better imaged on the OGA data.

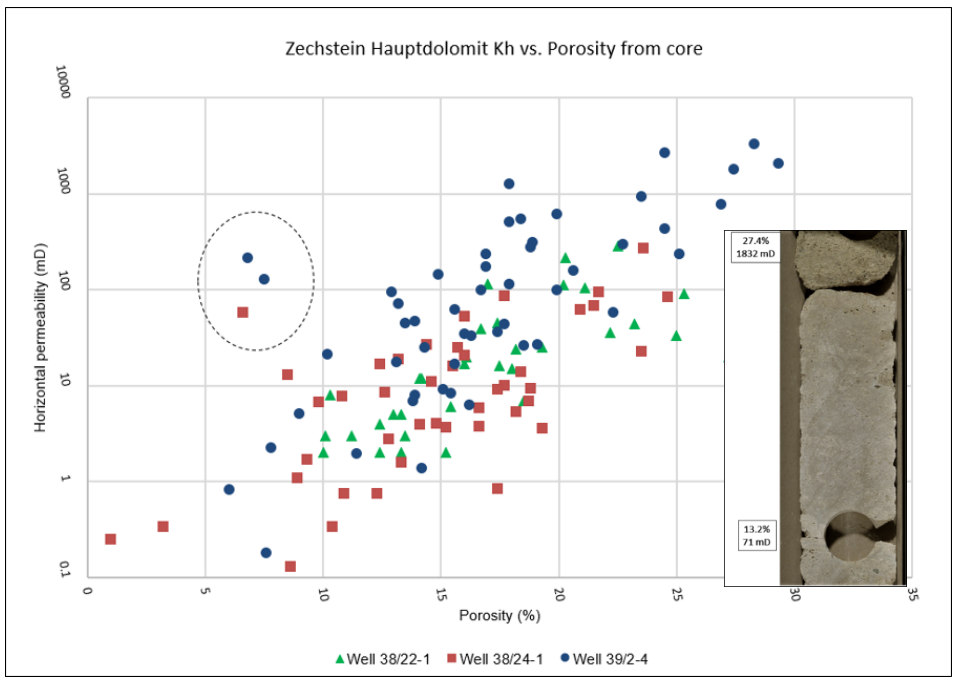
4.3 Reservoir and top seal pairs

4.3.1 Zechstein Hauptdolomit

In the area of interest the Hauptdolomit is 40-65 m thick and consists mainly of platform carbonates deposited as ooid and oncolite shoals in a platform and lagoon setting with local stromatolite development. The rocks are heavily dolomitised which has resulted in enhanced porosity and permeability. These rocks outcrop onshore in Northeast England allowing detailed investigation of the lateral and vertical facies relationships as well as fracture patterns. Field studies in England have shown good lateral extent of the carbonate platform facies for at least 15 km with a thickness close to what is seen offshore in our area of interest; ca. 50 m. These field studies, seismic stratigraphy and well core studies support the existence of large laterally extensive platform type carbonate reservoirs overlying the seismically mappable sulphate platforms.







Where developed as high-energy platform facies, both in offshore well data and in onshore outcrops, the Hauptdolomit has a net reservoir thickness of 25-40 m, average porosity of 17-22 % and an average permeability of ca. 50 mD. Locally, the permeability is enhanced by fractures. The Hauptdolomit is locally intensively fractured mainly by sets of near vertical fractures. The fracture patterns are well exposed in onshore and observed in core data, however because of the largely vertical nature of these fractures they are easily missed by a vertical wellbore. Drill stem tests were performed in wells 38/16-1 and 44/7-1 resulting in flow rates of up to 1,440 bbls of water per day supporting the flow potential of these reservoirs. Drilling of the Hauptdolomit in well 44/7-1 was also characterised by severe circulation losses indicative of permeable/fractured formation. The Hauptdolomit is overlain by anhydrite and/or halite belonging to the Basalanhydrit and Stassfurt Halite, respectively, representing excellent top seals for retainment of hydrocarbons.

4.3.2 Secondary reservoirs

Plattendolomit, Zechsteinkalk and Lower Carboniferous

In addition to the Hauptdolomit, Zechstein dolomites and limestones with reservoir potential are also present at higher and lower stratigraphic levels within the Zechstein Group, namely the Plattendolomit (younger) and Zechsteinkalk (older). They are normally thin (ca. 10 m or less) and it has not been possible to map these potential secondary targets with the current database, and the Plattendolomit volume potential has been estimated using an iso-shift from top Zechstein. The Zechsteinkalk is located at the base of the Zechstein Group and may constitute an additional reservoir overlying truncated Lower Carboniferous sandstones (Fell and Cementstone formations), however, we have only been able to identify low relief closures with a limited volumetric potential at this level and hence not calculated any volumes for the Zechsteinkalk. The truncated Lower Carboniferous sandstones also represent upside potential, especially in the Durham prospect, although the current volumetric potential estimate is modest.

Devonian Buchan and Kyle, and Basement

The lowermost sedimentary package sequence consists of the Upper Devonian Buchan Formation sandstones and the Middle Devonian Kyle Formation limestones which overlie fractured/altered Basement. As the structural closures in Balvenie broaden and increase in size with depth below base

Buchan Formation

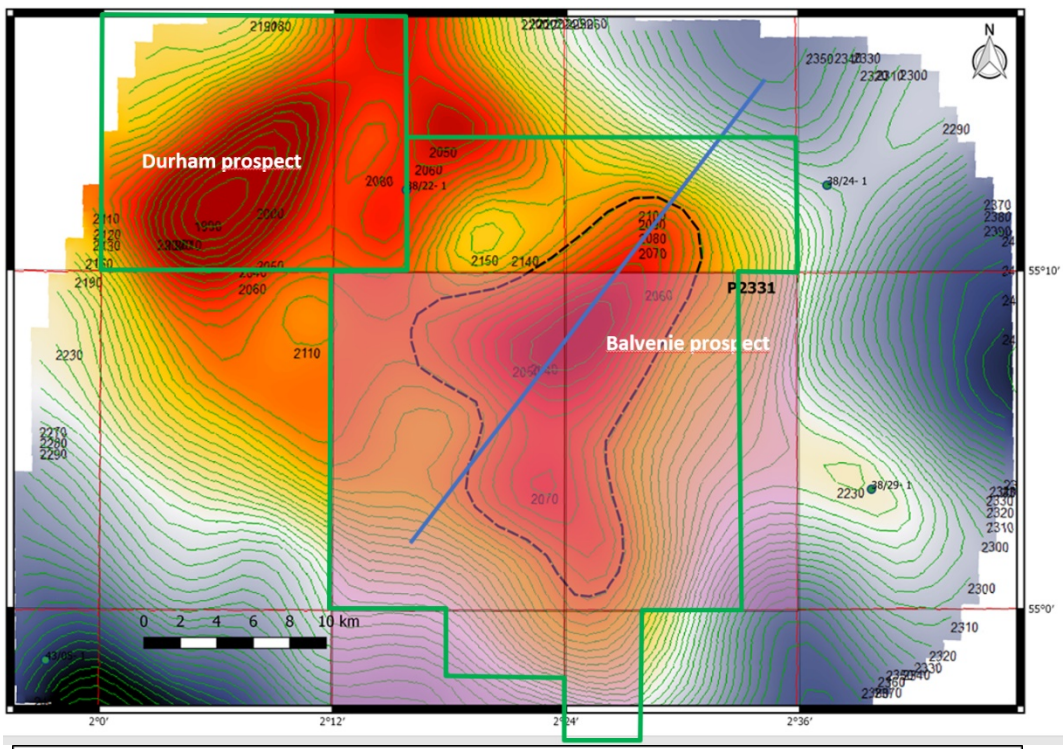
Kyle Formation

Fractured Basement

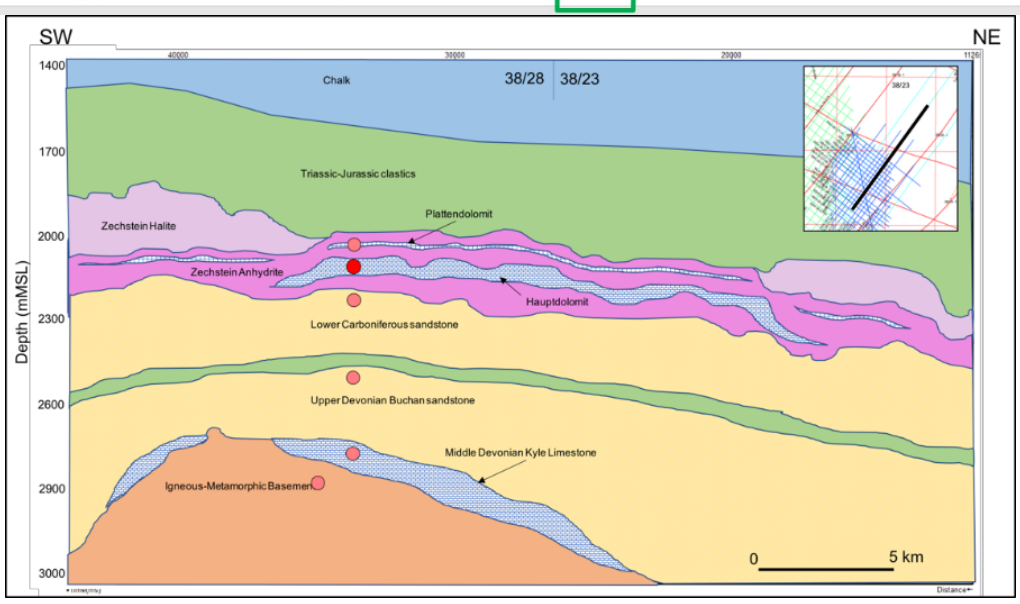
Zechstein, these reservoirs represent volumetrically interesting targets in the Balvenie prospect with a mean recoverable gas potential of 870 BCF (Buchan), 312 BCF (Kyle) and 1277 BCF (Fractured Basement), respectively. Both the Buchan and fractured Basement are technically proven plays on the UKCS, and well 37/25-1 located northwest of P2331 penetrated the Buchan with fair porosity and had elevated gas shows in Basement rocks. The Kyle remains an unproven play but has producing analogues in the Timan-Pechora Basin in Russia as well as in western Canada. These formations all have low porosity and permeability, and hence technical and commercial success may be dependent on fracture permeability. Within the Balvenie prospect the Buchan/Kyle/Basement package can be targeted through deepening of an exploration well below the base Zechstein down to ca. 2700 m.

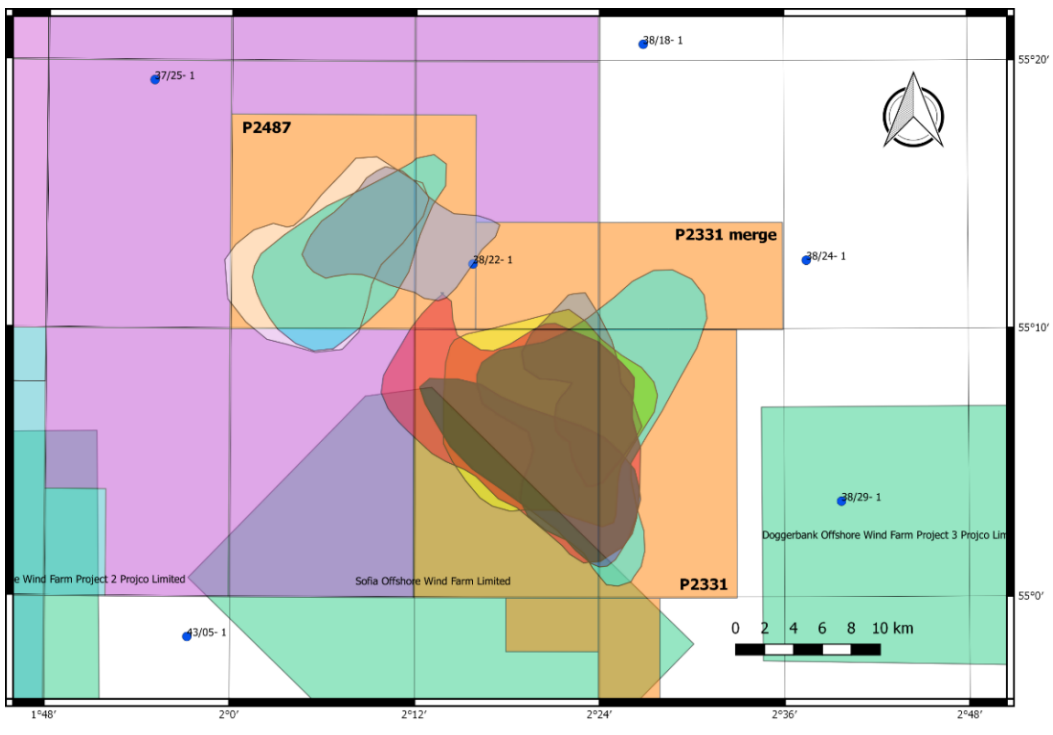
5. Trap geometry

Through establishment of a seismic stratigraphic framework and a combination of the new OGA seismic data and legacy seismic, the Balvenie (P2331) and Durham (P2487) very large multiple target 4-way dip closures were identified and mapped. The 178 km^2 Balvenie Hauptdolomit is the largest of these, with ca. 80 m closure height. For other reservoir levels the structural closures vary in size between 56 km^2 and 175 km^2 with closure heights varying from 35 m for Balvenie Lower Carboniferous to 190 m in Balvenie Fractured Basement.



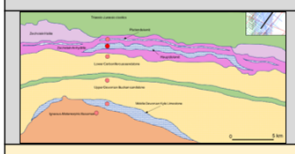
In both the Balvenie and Durham prospects, all targets are largely superimposed, and can probably be penetrated within their structural closure with a single exploration well in both Balvenie and Durham. It should be noted that there is stratigraphic trapping volume upside potential especially in the Hauptdolomit targets as the dolomite facies are likely to be flanked by halite providing an effective side seal. Other targets may also have stratigraphic or combination trap mechanism volume potential upside. A clarification of this upside is likely to be revealed through acquisition of 3D seismic data.





6. Summary and Way Forward

Through comprehensive geological and geophysical work, the Balvenie and Durham prospects have been matured into **High-Impact Opportunities** with a combined potential of almost 2 TCF of recoverable gas potential in their primary Hauptdolomit targets and a substantial additional potential in secondary targets of up to 3 TCF recoverable gas. Although still considered primarily a gas play, recent exploration results have strengthened the possibility for oil, and there is a fair probability for finding considerable amounts of oil, particularly in the Balvenie Hauptdolomit target.

Target	Lithology	Mean Recoverable Gas Volume (BCF)	
		P2331 Balvenie Prospect	P2487 Durham Prospect
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Fractured Basement	Granitic	1271	-

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The farm-out process is as follows:

- Data package and data room available after signing of a Confidentiality Agreement
- Deals can be made at any time on a *first come – first* serve basis
- Equity is available in exchange for coverage of carry of the 3D seismic programme, historic costs, and/or a cash offer
- Available equity will be proportional to the cost of the work programme elements
- Bid deadline 31st of January 2020

Bid preference order:

- Full carry on 3D seismic acquisition and processing and partial coverage of historic costs
- Cash offer

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Figure references

1. Introduction
   Figure 1 (Overview map): © Crown copyright 2015
2. Regional geology and main petroleum plays
   Figure 1 (MNSH map): *From* Monaghan, A.A., et al., 2017: Carboniferous petroleum systems around the Mid North Sea High, UK.
   Figure 2 (Stratigraphic column): *Modified from* Patruno, S., et al., 2017: New insights into the unexploited reservoir potential of the Mid North Sea High (UKCS quadrants 35–38 and 41–43): a newly described intra-Zechstein sulphate–carbonate platform complex.

4.3.1 Zechstein Hauptdolomit

Figure 2 (Depositional model block diagram): *From* EBN, 2016: Zechstein Carbonates revisited, new insights and new changes for an old play. *Dutch Exploration day 2016*
All core photographs from British Geological Survey materials © NERC
All seismic sections: © Crown copyright 2015